TMDL Development for the Floyds Fork Watershed

Draft Watershed Hydrology and Water Quality Calibration

Louisville, KY
November 15, 2011
Presentation Updated – November 28, 2011

EPA United States Environmental Protection Agency

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Presenters

- Tim Wool — National TMDL Expert
  Water Quality Modeler, TOM
- Brian Watson — Director, Water Resources Group
  Tetra Tech, Atlanta

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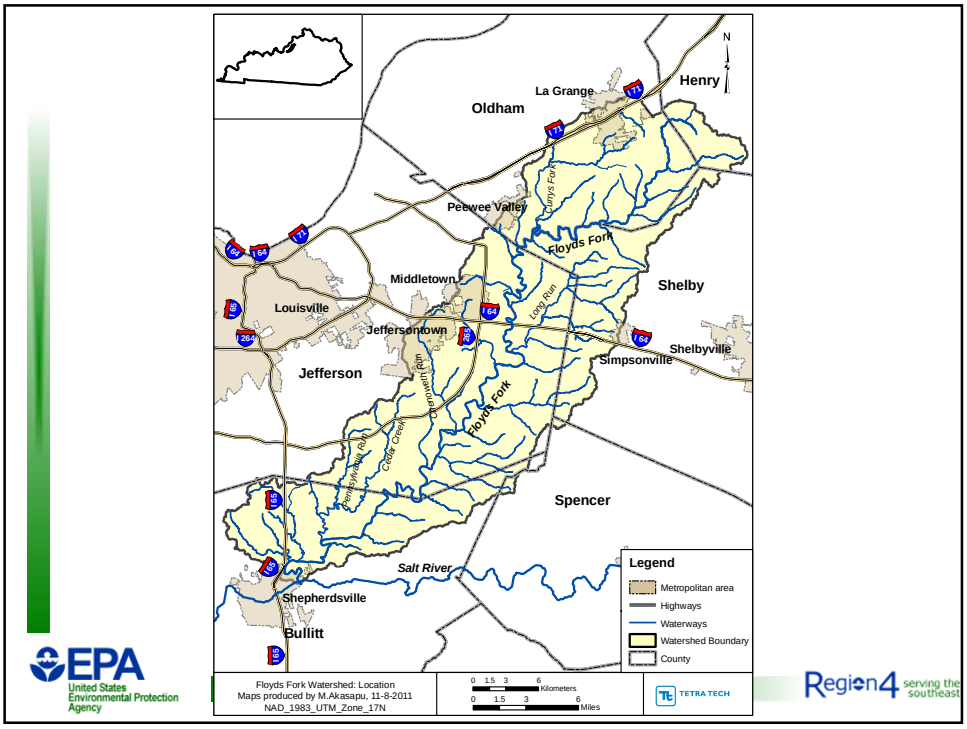

Summary of Data Sources

- KDOW
  - Lat/Longs for 73 NPDES Facilities and 11 Water Withdrawals
  - Lat/Longs for 49 Water Quality sites (26 USGS, 11 Currys Fork WBP, 7 MSD, 3 Bullitt WBP, 2 KDOW)
  - Water Withdrawal Information (Lat/Longs and pumping data)
  - KDOW Management Decisions Document. This document contained key information about expectations of the TMDL effort.
  - MS4 Information
  - Lat/Longs for 33 Assessment Points in watershed
  - Preliminary information on Water Quality Targets for Floyds Fork watershed
- USGS
  - Flow Data for Period of Record at 7 Stations
  - Water Quality Chemistry Data for 2007 and 2008 for 25 stations.

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Summary of Data Sources

- MSD
  - Information for Weather Stations (TR and RG Stations).
  - Water Quality Chemistry Data. This includes data for 5 stations for the period of record.
  - Sonde data at 5 Locations
  - Floyds Fork Action Plan Update
  - Septic Tank Shapefile for Floyds Fork Watershed.
  - Links to key Water Quality Synthesis Reports and other online documents
  - SSO Information and data
  - 11 GIS Coverages including contours, Dfirms, etc.

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Subwatershed Delineations

- Started with NHD Catchments
- Edited those Catchments
  - Combined watersheds
- Began detailed subwatershed delineations
  - County Boundaries
  - Topography and Connectivity
  - USGS Flow and Water Quality Stations
  - MSD Water Quality Stations
  - Point Source Locations
  - Impaired Segments
  - KDOW Assessment Points

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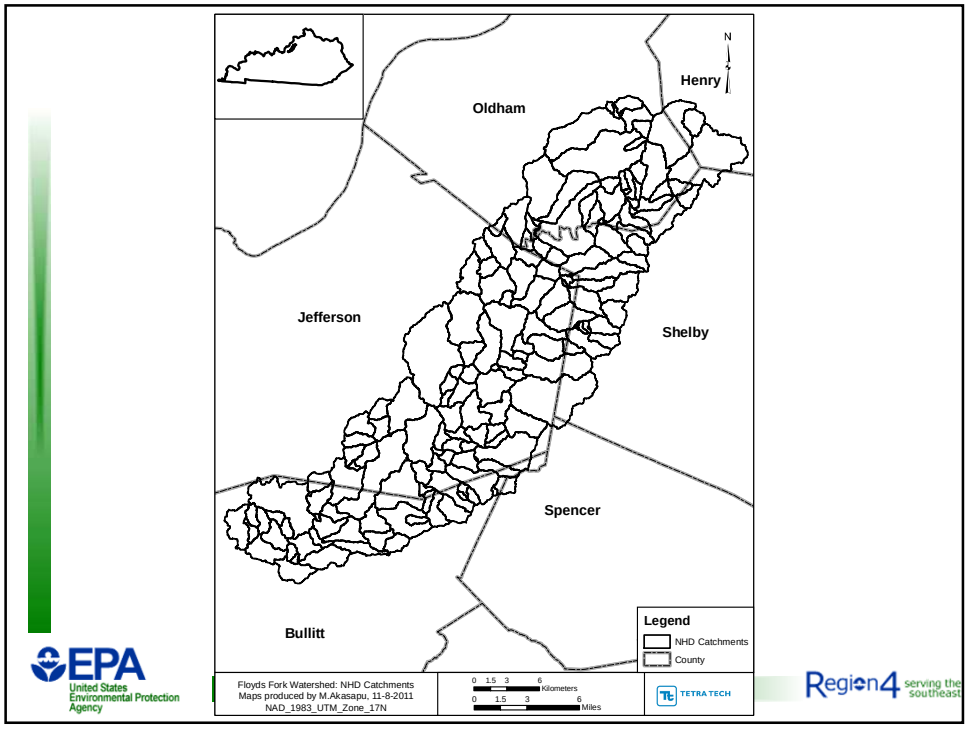
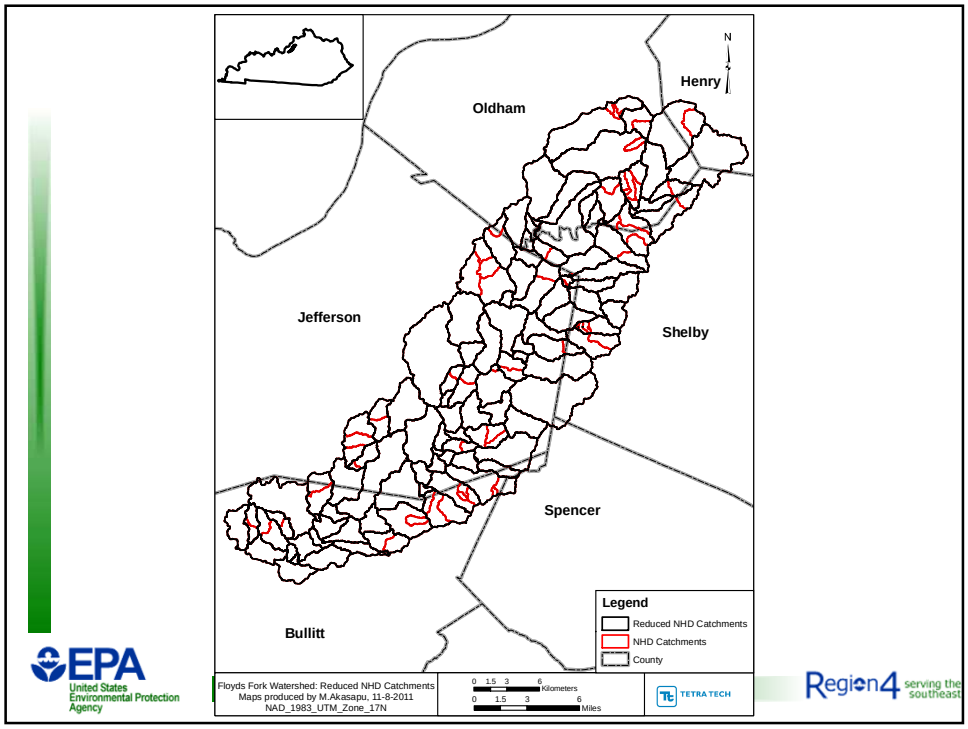
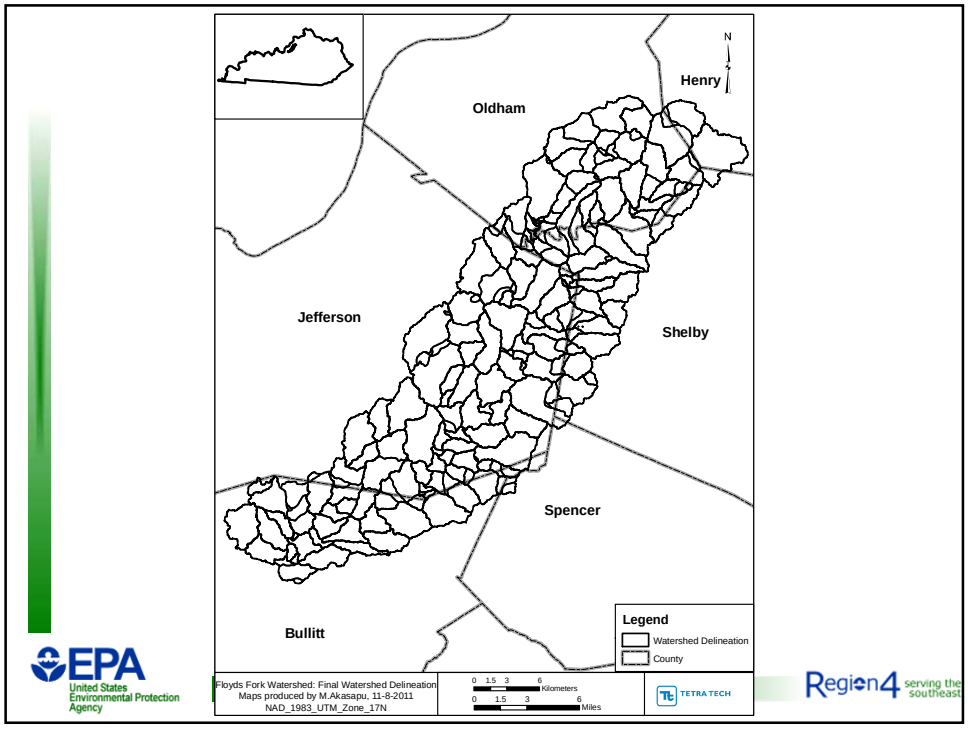
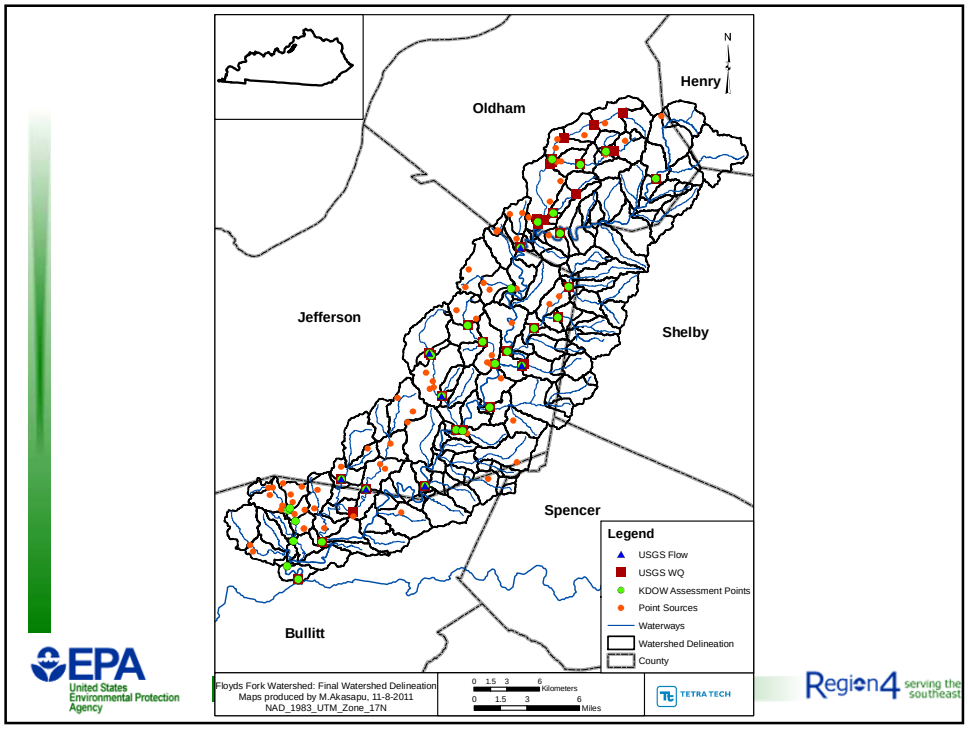
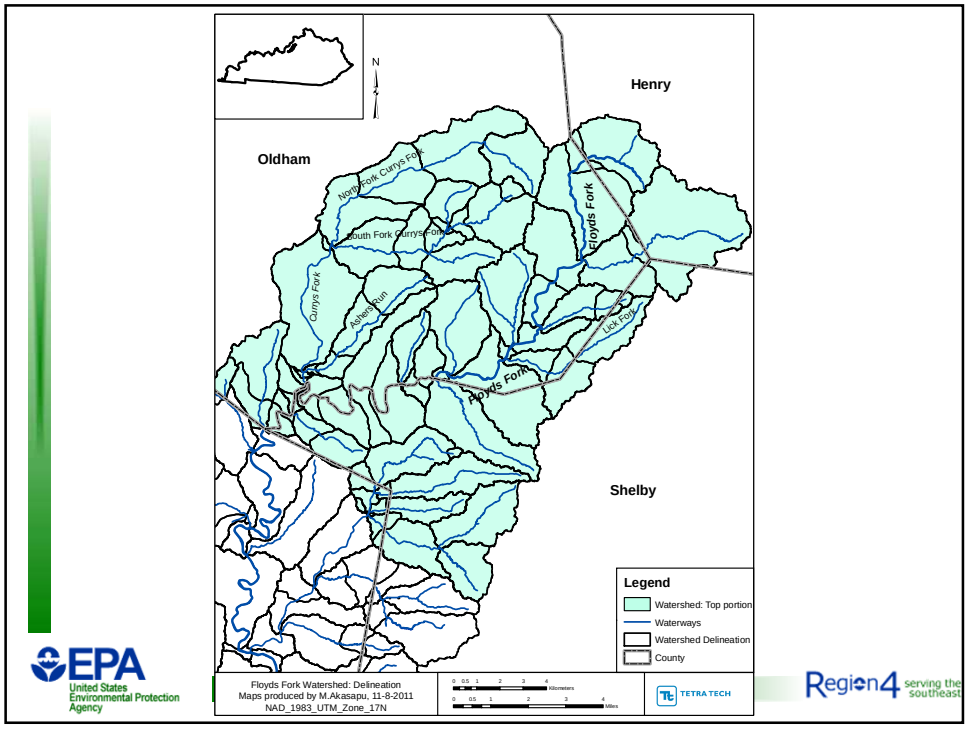
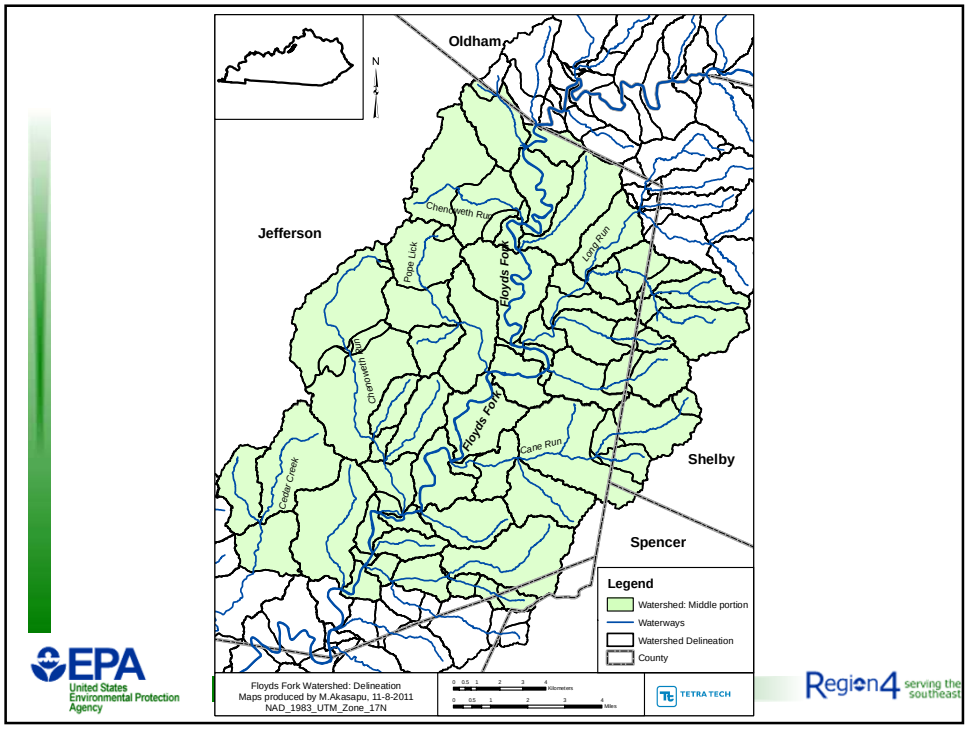

N
Henry
Oldham
Jefferson
Shelby
Spencer
Bullitt
Legend
NHD Catchments
County
Floyds Fork Watershed: NHD Catchments
Maps produced by M.Akasapu, 11-8-2011
NAD_1983_UTM_Zone_17N
0 1.5 3 6 Kilometers
0 1.5 3 6 Miles
TETRA TECH
EPA
United States
Environmental Protection
Agency
Region4 serving the southeast

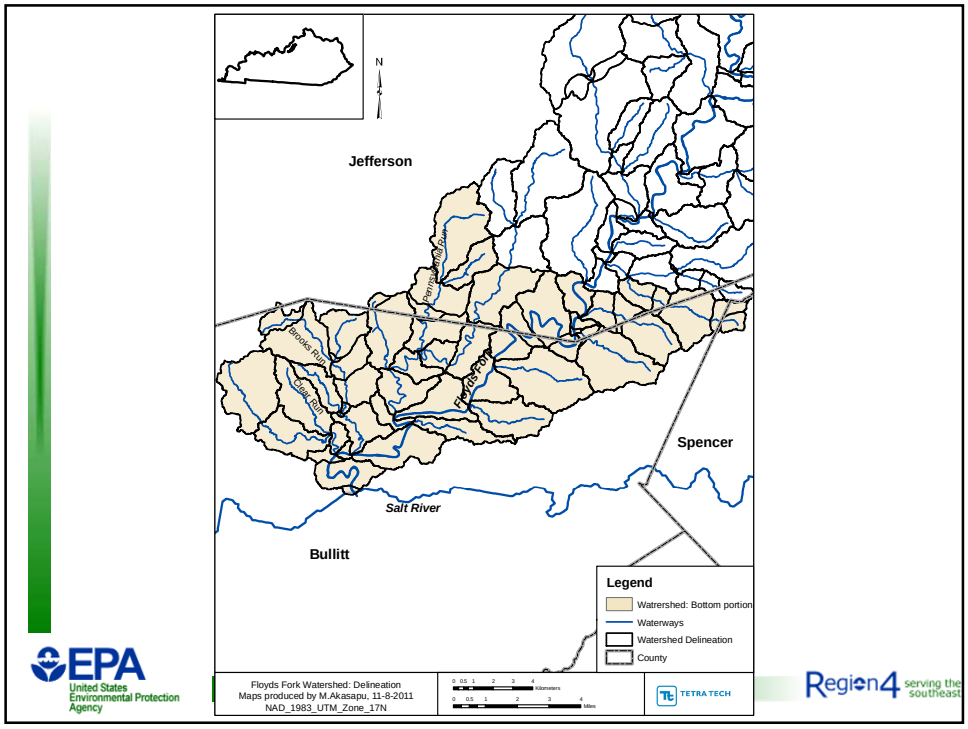

N
Henry
Oldham
Jefferson
Shelby
Spencer
Bullitt
Legend
Reduced NHD Catchments
NHD Catchments
County
Floyds Fork Watershed: Reduced NHD Catchments
Maps produced by M.Akasapu, 11-8-2011
NAD_1983_UTM_Zone_17N
0 1.5 3 6 Kilometers
0 1.5 3 6 Miles
TETRA TECH
EPA
United States
Environmental Protection
Agency
Region4 serving the southeast

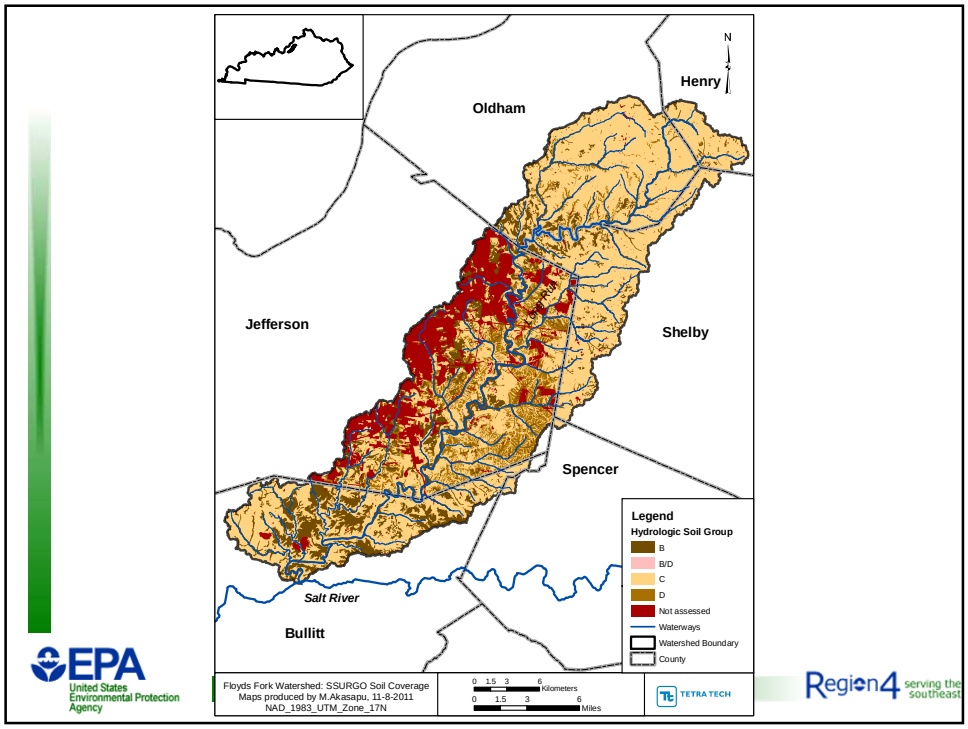

N
Henry
Oldham
Jefferson
Shelby
Spencer
Bullitt
Legend
Watershed Delineation
County
Floyds Fork Watershed: Final Watershed Delineation
Maps produced by M.Akasapu, 11-8-2011
NAD_1983_UTM_Zone_17N
0 1.5 3 6 Kilometers
0 1.5 3 6 Miles
TETRA TECH
EPA
United States
Environmental Protection
Agency
Region4 serving the southeast

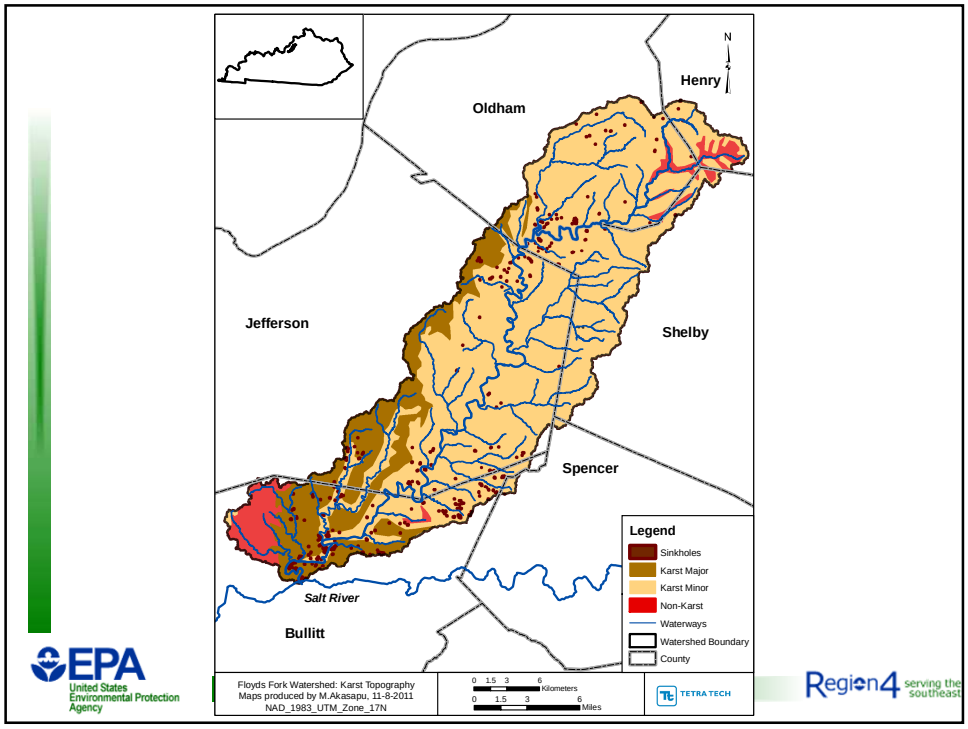

N
Henry
Oldham
Jefferson
Shelby
Spencer
Bullitt
Legend
USGS Flow
USGS WQ
KDOW Assessment Points
Point Sources
Waterways
Watershed Delineation
County
Floyds Fork Watershed: Final Watershed Delineation
Maps produced by M.Akasapu, 11-8-2011
NAD_1983_UTM_Zone_17N
0 1.5 3 6 Kilometers
0 1.5 3 6 Miles
TETRA TECH
EPA
United States
Environmental Protection
Agency
Region4 serving the southeast

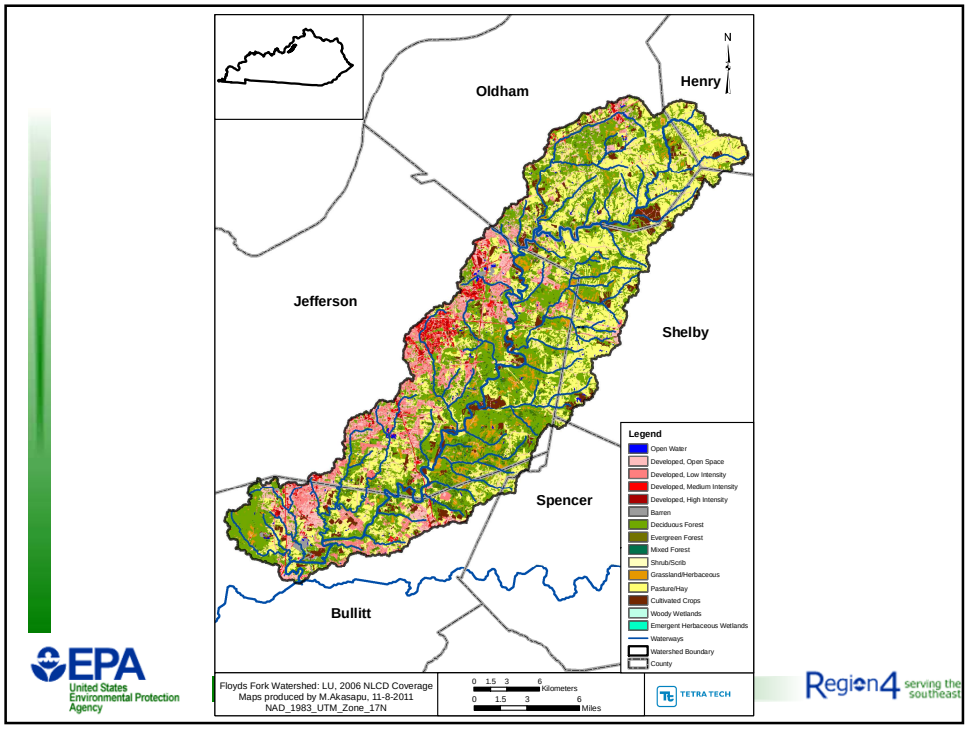

Henry
Oldham
Shelby
North Fork Currys Fork
South Fork Currys Fork
Currys Fork
Ashers Run
Floyds Fork
Lick Fork
Legend
Watershed: Top portion
Waterways
Watershed Delineation
County
Floyds Fork Watershed: Delineation
Maps produced by M.Akasapu, 11-8-2011
NAD_1983_UTM_Zone_17N
EPA
United States
Environmental Protection
Agency
TETRA TECH
Region4 serving the southeast


Oldham
Jefferson
Shelby
Spencer
Chenoweth Run
Pope Lick
Floyds Fork
Long Run
Mill Creek
Cane Run
Cedar Creek
Legend
Watershed: Middle portion
Waterways
Watershed Delineation
County
Floyds Fork Watershed: Delineation
Maps produced by M.Akasapu, 11-8-2011
NAD_1983_UTM_Zone_17N
EPA
United States
Environmental Protection
Agency
TETRA TECH
Region4 serving the southeast


N
Jefferson
Spencer
Bullitt
Salt River
Floyds Fork
Legend
Watrershed: Bottom portion
Waterways
Watershed Delineation
County
Floyds Fork Watershed: Delineation
Maps produced by M.Akasapu, 11-8-2011
NAD_1983_UTM_Zone_17N
EPA
United States
Environmental Protection
Agency
TETRA TECH
Region4 serving the southeast


N
Henry
Oldham
Jefferson
Shelby
Spencer
Bullitt
Salt River
Legend
Hydrologic Soil Group
B
B/D
C
D
Not assessed
Waterways
Watershed Boundary
County
Floyds Fork Watershed: SSURGO Soil Coverage
Maps produced by M.Akasapu, 11-8-2011
NAD_1983_UTM_Zone_17N
EPA
United States
Environmental Protection
Agency
TETRA TECH
Region4 serving the southeast


Oldham
Henry
Jefferson
Shelby
Spencer
Salt River
Bullitt
N
Legend
Sinkholes
Karst Major
Karst Minor
Non-Karst
Waterways
Watershed Boundary
County
Floyds Fork Watershed: Karst Topography
Maps produced by M.Akasapu, 11-8-2011
NAD_1983_UTM_Zone_17N
0 1.5 3 6 Kilometers
0 1.5 3 6 Miles
TETRA TECH
EPA
United States
Environmental Protection
Agency
Region4 serving the southeast


Oldham
Henry
Jefferson
Shelby
Spencer
Bullitt
N
Legend
Open Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub/Scrib
Grassland/Herbaceous
Pasture/Hay
Cultivated Crops
Woody Wetlands
Emergent Herbaceous Wetlands
Waterways
Watershed Boundary
County
Floyds Fork Watershed: LU, 2006 NLCD Coverage
Maps produced by M.Akasapu, 11-8-2011
NAD_1983_UTM_Zone_17N
0 1.5 3 6 Kilometers
0 1.5 3 6 Miles
TETRA TECH
EPA
United States
Environmental Protection
Agency
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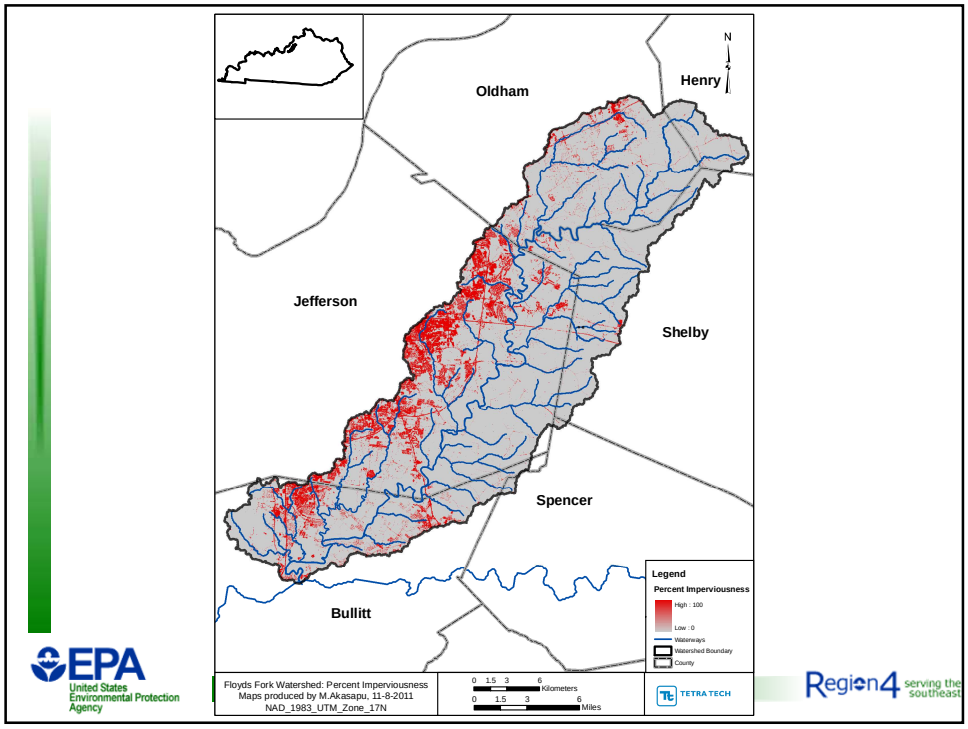
Oldham
Henry
Jefferson
Shelby
Spencer
Bullitt
N
Legend
Percent Imperviousness
High : 100
Low : 0
Waterways
Watershed Boundary
County
Floyds Fork Watershed: Percent Imperviousness
Maps produced by M.Akasapu, 11-8-2011
NAD_1983_UTM_Zone_17N
0 1.5 3 6 Kilometers
0 1.5 3 6 Miles
TETRA TECH
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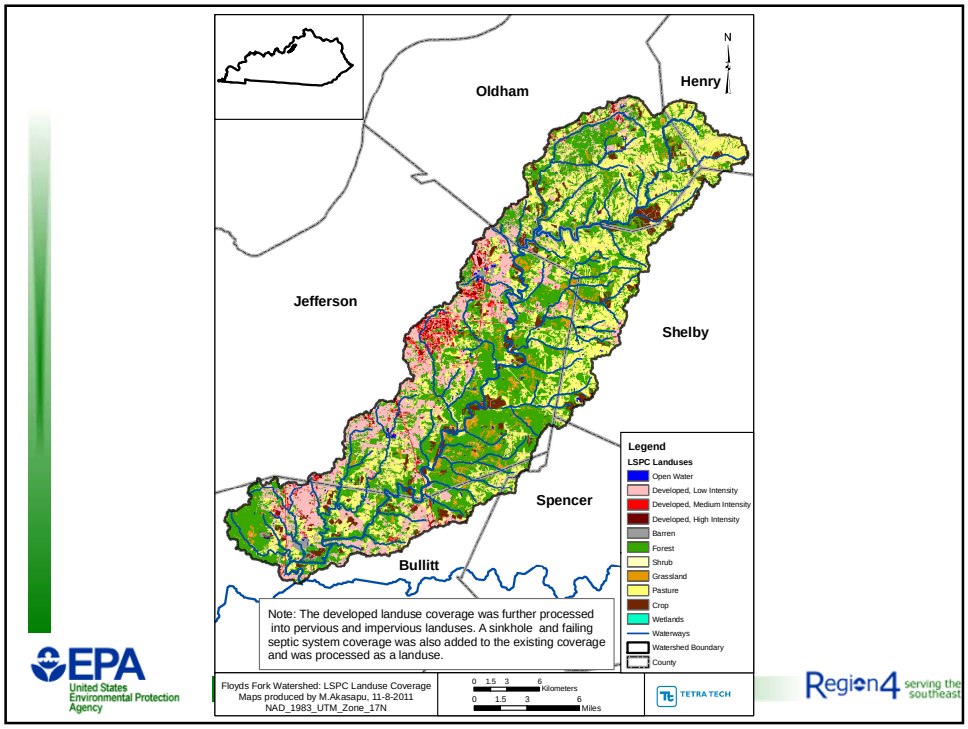
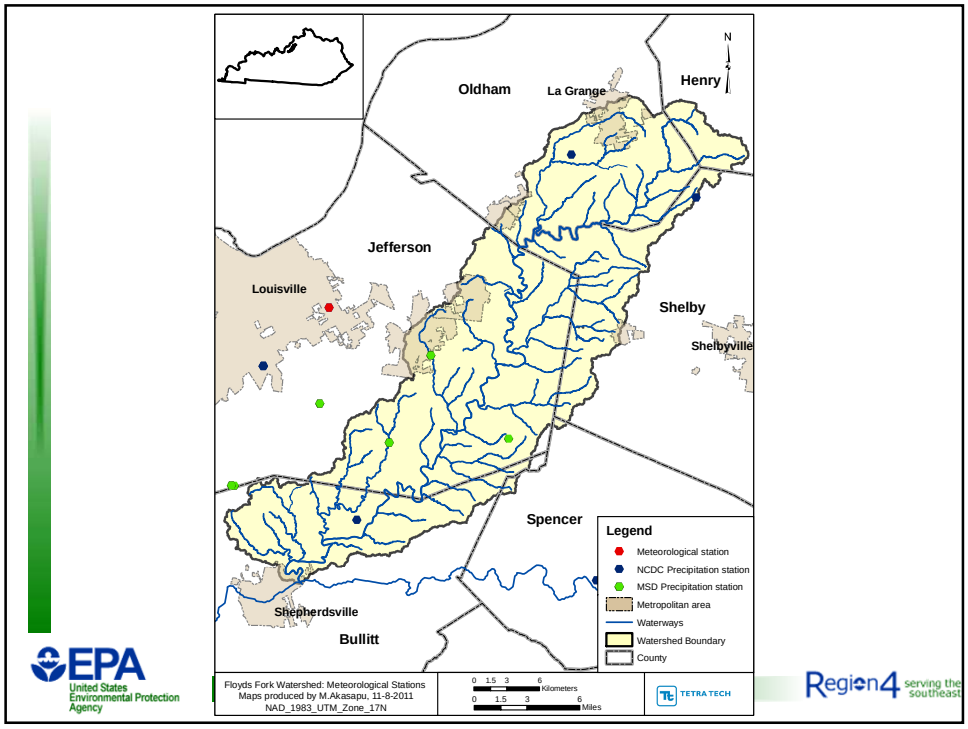
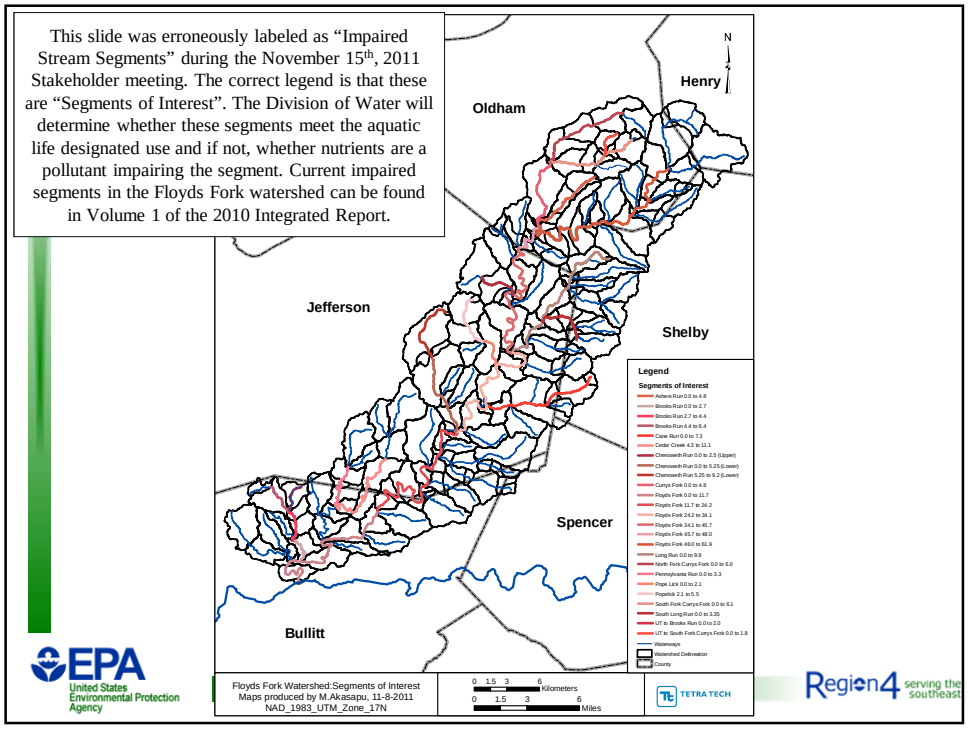

Oldham
Henry
Jefferson
Shelby
Spencer
Bullitt
N
Legend
LSPC Landuses
Open Water
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren
Forest
Shrub
Grassland
Pasture
Crop
Wetlands
Waterways
Watershed Boundary
County
Note: The developed landuse coverage was further processed into pervious and impervious landuses. A sinkhole and failing septic system coverage was also added to the existing coverage and was processed as a landuse.
Floyds Fork Watershed: LSPC Landuse Coverage
Maps produced by M.Akasapu, 11-8-2011
NAD_1983_UTM_Zone_17N
0 1.5 3 6 Kilometers
0 1.5 3 6 Miles
TETRA TECH
EPA United States Environmental Protection Agency
Region4 serving the southeast



This slide was erroneously labeled as "Impaired Stream Segments" during the November 15th, 2011 Stakeholder meeting. The correct legend is that these are "Segments of Interest". The Division of Water will determine whether these segments meet the aquatic life designated use and if not, whether nutrients are a pollutant impairing the segment. Current impaired segments in the Floyds Fork watershed can be found in Volume 1 of the 2010 Integrated Report.



Cropland and Pasture Loading Rates

County	Total cropland area in the county, acres	Total cropland area in the watershed, acres	TN			TP			Total loading rates from fertilizers, lbs/acre/day	
			Total amount of fertilizer used, Tons	Fertilizer application rate, lbs/acre/day	Total Crop removal rates for the watershed in the county, lbs/acre/day	Total amount of fertilizer used, Tons	Fertilizer application rate, lbs/acre/day	Total Crop removal rates for the watershed in the county, lbs/acre/day	TN	TP
Bullitt	7253	1675	107	0.081	0.177	33	0.025	0.028	0[A]	0[A]
Henry	6421	208	2121	1.810	0.395	396	0.338	0.047	1.415	0.290
Jefferson	4576	2846	2818	3.374	0.156	361	0.433	0.025	3.218	0.408
Oldham	7879	2380	767	0.534	0.247	150	0.104	0.041	0.287	0.063
Shelby	26685	1255	2840	0.583	0.332	653	0.134	0.055	0.251	0.080
Spencer	9118	3	490	0.294	0.126	127	0.076	0.018	0.168	0.058

A = Calculated Crop Removal Rate is larger than application rate, therefore, the loading rate was set = 0.

County	Total cropland area in the county, acres	Total cropland area in the watershed, acres	Cropland					
			TN			TP		
			Manure loadings rates for cropland*, lbs/acre/day	Averaged manure uptake by crops, lbs/acre/day	Total loading rate from manure, lbs/acre/day	Manure loadings rates for cropland*, lbs/acre/day	Averaged manure uptake by crops, lbs/acre/day	Total loading rate from manure, lbs/acre/day
Bullitt	7253	1675	0.054	0.010	0.044	0.019	0.006	0.013
Henry	6421	208	0.064	0.009	0.054	0.021	0.006	0.016
Jefferson	4576	2846	0.039	0.014	0.026	0.016	0.008	0.008
Oldham	7879	2380	0.044	0.012	0.033	0.016	0.007	0.009
Shelby	26685	1255	0.051	0.010	0.041	0.017	0.006	0.012
Spencer	9118	3	0.059	0.009	0.050	0.020	0.005	0.015

* Source for this manure loading rate: Beef cattle, Dairy cattle, Horse, Poultry and Pigs

County	Total pastureland area in the county, acres	Total pastureland area in the watershed, acres	Pastureland					
			TN			TP		
			Manure loadings rates for Pastureland**, lbs/acre/day	Averaged manure uptake by crops, lbs/acre/day	Total loading rate from manure, lbs/acre/day	Manure loadings rates for Pastureland**, lbs/acre/day	Averaged manure uptake by crops, lbs/acre/day	Total loading rate from manure, lbs/acre/day
Bullitt	24564	6417	0.051	0.008	0.044	0.022	0.002	0.020
Henry	90629	3966	0.063	0.005	0.058	0.028	0.002	0.026
Jefferson	19198	12619	0.038	0.011	0.026	0.015	0.003	0.012
Oldham	40204	12969	0.044	0.009	0.035	0.020	0.003	0.017
Shelby	125103	12651	0.050	0.006	0.044	0.023	0.002	0.021
Spencer	39808	381	0.057	0.005	0.052	0.023	0.002	0.022

* Source for this manure loading rate: Beef cattle, Dairy cattle, Horse

This slide was updated since the November 15th, 2011 Stakeholder meeting.

Cropland and Pasture Loading Rates

County	Averaged monthly loading rates for Cropland, lbs/acre/day		Averaged monthly loading rates for Pastureland, lbs/acre/day	
	TN	TP	TN	TP
Bullitt	0.044	0.013	0.048	0.020
Henry	0.762	0.161	0.060	0.026
Jefferson	1.635	0.212	0.033	0.012
Oldham	0.176	0.041	0.040	0.017
Shelby	0.167	0.051	0.047	0.021
Spencer	0.134	0.044	0.054	0.022

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This slide was updated since the November 15th, 2011 Stakeholder meeting.

Summary of Septic Numbers

County	No. of Septics in the county	No. of Septics in the watershed	Failing %	Non-Failing %
Bullitt	11,109	1,981	20	80
Henry	5,000	159	20	80
Jefferson	44,131	13,620	20	80
Oldham	8,500	2,500	30	70
Shelby	7,729	826	20	80
Spencer	3,171	6	20	80

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Hydrology Calibration

- Calibration period
  - January 1, 2001 through December 31, 2010
- 7 USGS Stations
  - 3 Main Stem
  - 4 Tributaries
- Quantitative Calibration
  - Miscellaneous Plots
  - Summarized by Statistics
- Qualitative Calibration
  - Analyzed Statistics
  - Developed Qualitative Calibration

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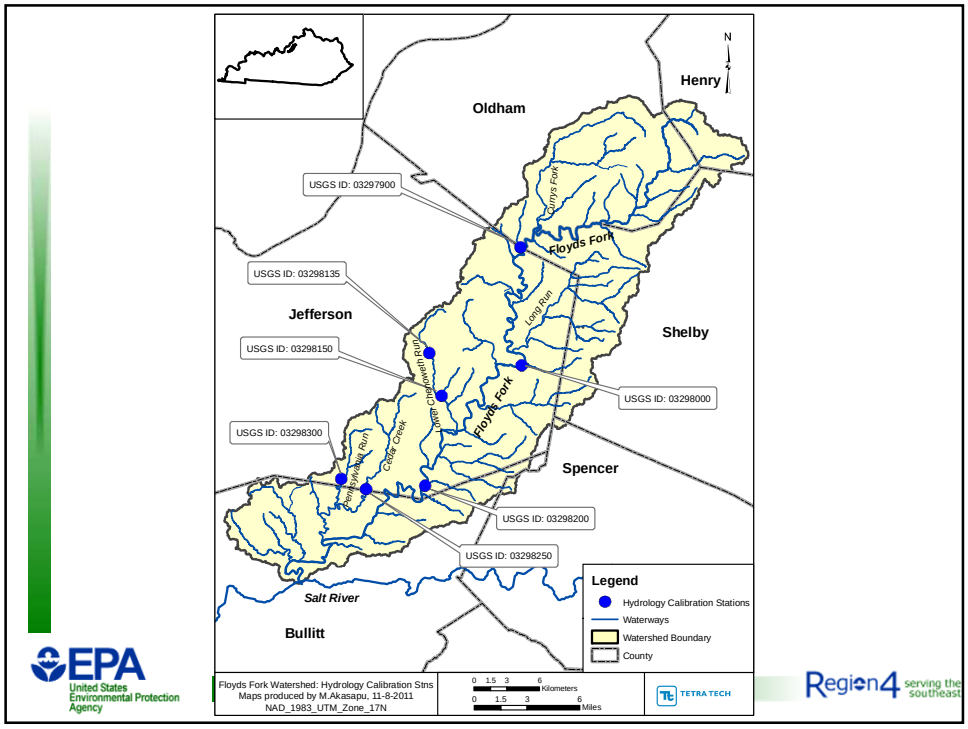
Henry
Oldham
Jefferson
Shelby
Spencer
Bullitt
Salt River
Floyds Fork
Long Run
Cedar Creek
Pennsylvania Run
USGS ID: 03297900
USGS ID: 03298135
USGS ID: 03298150
USGS ID: 03298000
USGS ID: 03298300
USGS ID: 03298200
USGS ID: 03298250
Legend
Hydrology Calibration Stations
Waterways
Watershed Boundary
County
Floyds Fork Watershed: Hydrology Calibration Stns
Maps produced by M.Akasapu, 11-8-2011
NAD_1983_UTM_Zone_17N
Kilometers
Miles
TETRA TECH
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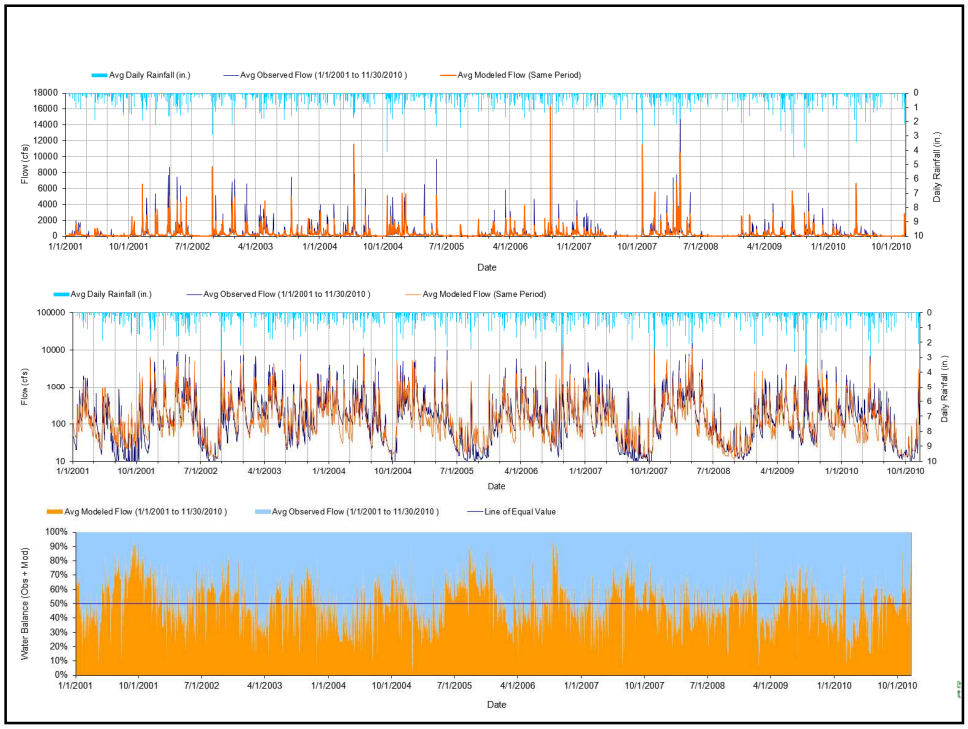
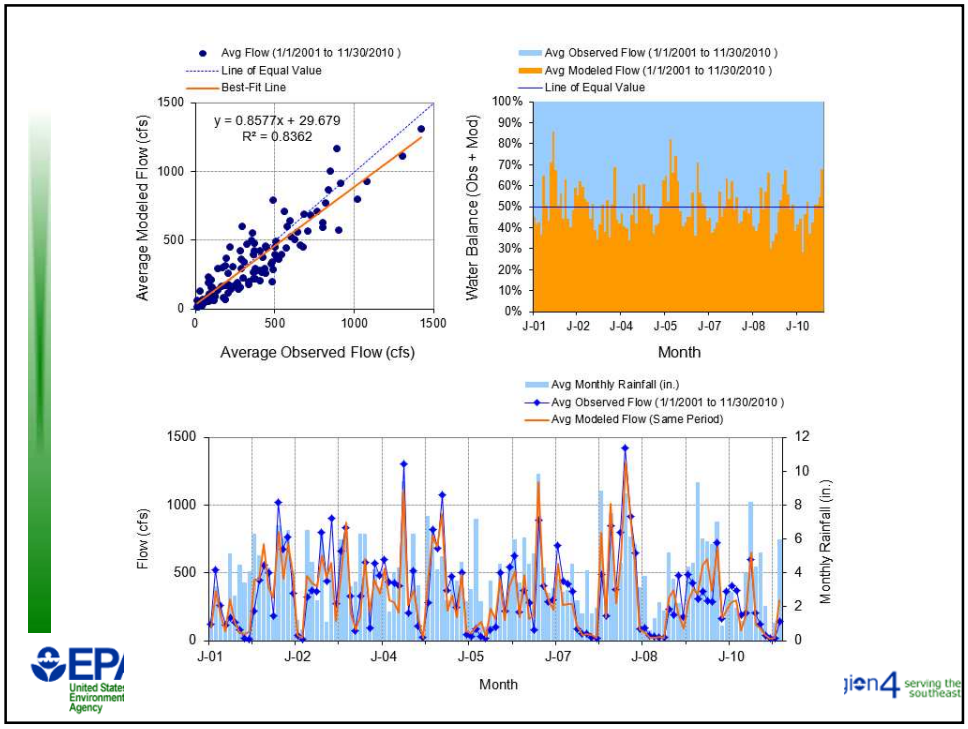
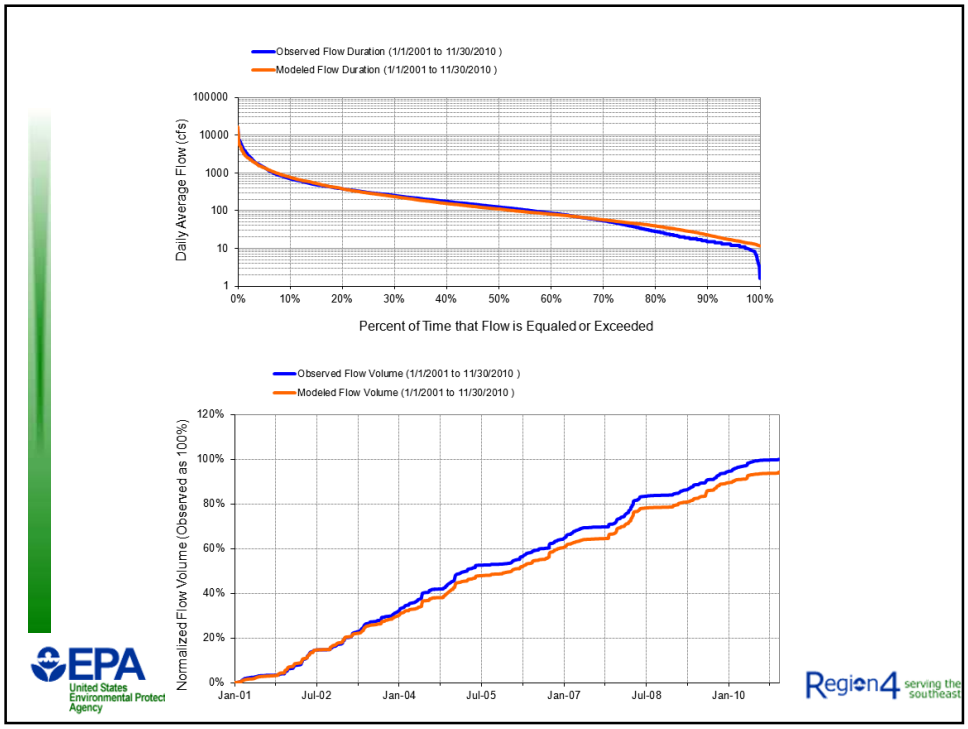

Avg Daily Rainfall (in.)
Avg Observed Flow (1/1/2001 to 11/30/2010)
Avg Modeled Flow (Same Period)
Flow (cfs)
Daily Rainfall (in.)
Date
Line of Equal Value
Water Balance (Obs + Mod)


Avg Flow (1/1/2001 to 11/30/2010)
Line of Equal Value
Best-Fit Line
y = 0.8577x + 29.679
R² = 0.8362
Average Modeled Flow (cfs)
Average Observed Flow (cfs)
Avg Observed Flow (1/1/2001 to 11/30/2010)
Avg Modeled Flow (1/1/2001 to 11/30/2010)
Line of Equal Value
Water Balance (Obs + Mod)
Month
Avg Monthly Rainfall (in.)
Avg Observed Flow (1/1/2001 to 11/30/2010)
Avg Modeled Flow (Same Period)
Flow (cfs)
Monthly Rainfall (in.)
Month


Observed Flow Duration (1/1/2001 to 11/30/2010)
Modeled Flow Duration (1/1/2001 to 11/30/2010)
Daily Average Flow (cfs)
Percent of Time that Flow is Equaled or Exceeded
Observed Flow Volume (1/1/2001 to 11/30/2010)
Modeled Flow Volume (1/1/2001 to 11/30/2010)
Normalized Flow Volume (Observed as 100%)

LSPC Simulated Flow		Observed Flow Gage	
REACH OUTFLOW FROM SUBBASIN 602 9.91-Year Analysis Period: 1/1/2001 - 11/30/2010 Flow volumes are (inches/year) for upstream drainage area		USGS 03298200 FLOYDS FORK NEAR MT WASHINGTON, KY Hydrologic Unit Code: 5140102 Latitude: 38.08534216 Longitude: -85.5549556 Drainage Area (sq-mi): 213	
Total Simulated In-stream Flow:	21.26	Total Observed In-stream Flow:	22.53
Total of simulated highest 10% flows:	12.25	Total of Observed highest 10% flows:	13.49
Total of Simulated lowest 50% flows:	1.64	Total of Observed Lowest 50% flows:	1.57
Simulated Summer Flow Volume (months 7-9):	3.13	Observed Summer Flow Volume (7-9):	2.62
Simulated Fall Flow Volume (months 10-12):	5.99	Observed Fall Flow Volume (10-12):	5.44
Simulated Winter Flow Volume (months 1-3):	6.15	Observed Winter Flow Volume (1-3):	7.87
Simulated Spring Flow Volume (months 4-6):	5.99	Observed Spring Flow Volume (4-6):	6.60
Total Simulated Storm Volume:	11.80	Total Observed Storm Volume:	13.71
Simulated Summer Storm Volume (7-9):	1.93	Observed Summer Storm Volume (7-9):	1.92
Errors (Simulated-Observed)	*Error Statistics*	*Recommended Criteria*	
Error in total volume:	-5.63	10	
Error in 50% lowest flows:	4.59	10	
Error in 10% highest flows:	-9.20	15	
Seasonal volume error - Summer:	19.53	30	
Seasonal volume error - Fall:	10.06	30	
Seasonal volume error - Winter:	-21.81	30	
Seasonal volume error - Spring:	-9.27	30	
Error in storm volumes:	-13.96	20	
Error in summer storm volumes:	0.57	50	
Nash-Sutcliffe Coefficient of Efficiency, E:	0.683	Model accuracy increases as E or E' approaches 1.0	
Baseline adjusted coefficient (Garrick), E':	0.528		

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Hydrology Calibration – Qualitative

- Weight Each Statistic
  - 1 (Low) – 4 (High)
- Develop Statistical Range
  - 1 (Poor) – 4 (Very Good)
- Multiply Weight and Statistical Range Score
- Sum up Values
  - 80 is the Highest Score
  - 20 is the Lowest Score

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Hydrology Calibration – Qualitative

- Very Good = 80-75
- Good = 74-55
- Fair = 54-35
- Poor = 35-20

Location: Main Stem- Floyds Fork			
USGS Station ID	Station name	Qualitative Score	Quantitative Score
03298200	Floyds Fork near Mt. Washington	VG	80
03297900	Floyds Fork near Peewee Valley	G	71
03298000	Floyds Fork at Fisherville	G	69
Location: Tributaries			
03298150	Chenoweth Run at Gelhaus Lane	VG	80
03298300	Pennsylvania Run at Mt. Washington	VG	76
03298135	Chenoweth Run at Ruckriegal Parkway	G	67
03298250	Cedar Creek at Thixton Road	G	67

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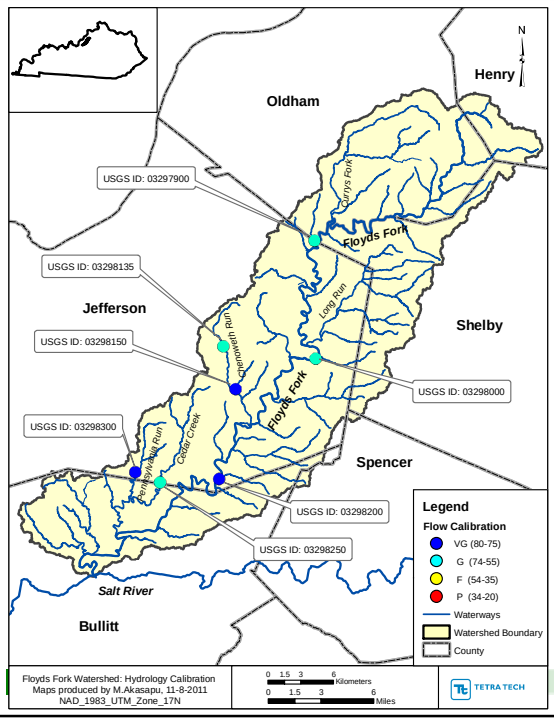
Region 4 serving the southeast



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Region 4 serving the southeast

Water Quality Calibration

- Calibration period
  - January 1, 2001 through December 31, 2010
- 25 USGS Stations
  - Primary period of data – 2007 and 2008
  - 8 Main Stem
  - 17 Tributaries
- 5 MSD
  - 3 Main Stem
  - 2 Tributaries (Lower Chenoweth Run)
- Quantitative Calibration
- Qualitative Calibration

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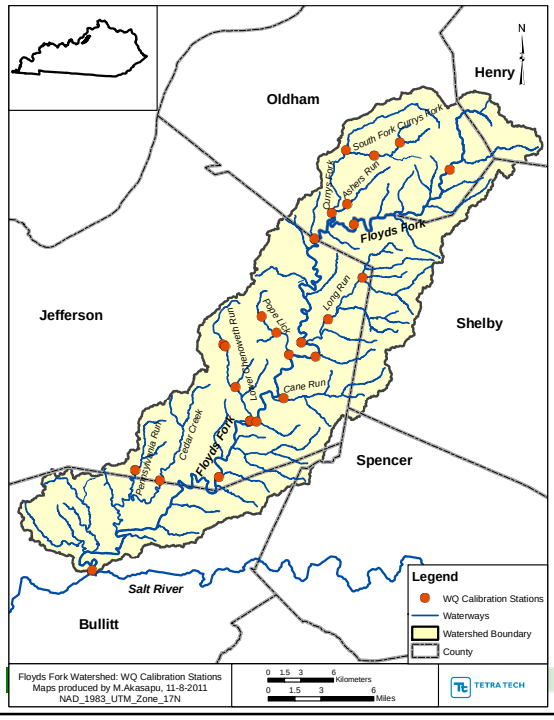
Region 4 serving the southeast



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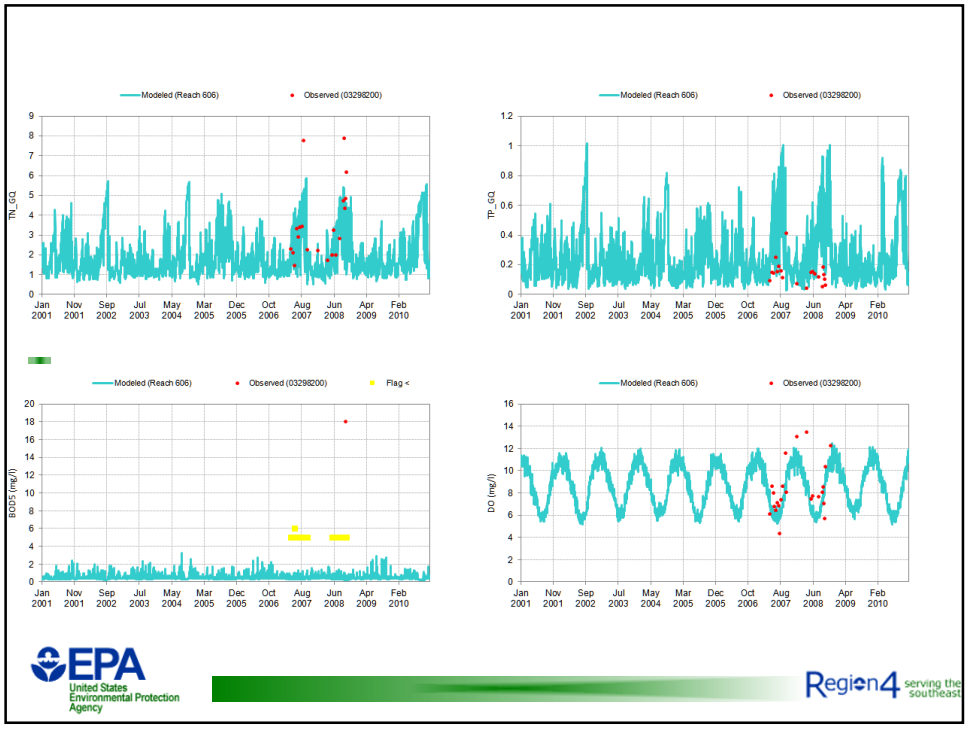
Region 4 serving the southeast


Modeled (Reach 606)
Observed (03298200)
TN_GQ
TP_GQ
Flag <
BOD5 (mg/l)
DO (mg/l)
Jan 2001
Nov 2001
Sep 2002
Jul 2003
May 2004
Mar 2005
Dec 2005
Oct 2006
Aug 2007
Jun 2008
Apr 2009
Feb 2010
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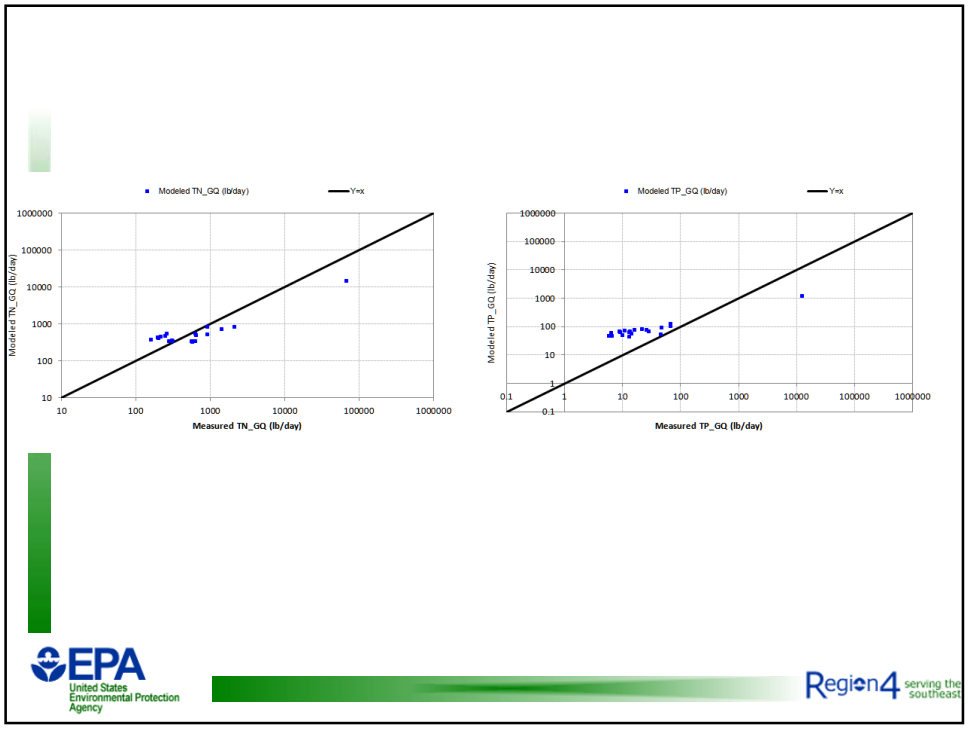
Modeled TN_GQ (lb/day)
Y=x
Modeled TN_GQ (lb/day)
Measured TN_GQ (lb/day)
Modeled TP_GQ (lb/day)
Y=x
Modeled TP_GQ (lb/day)
Measured TP_GQ (lb/day)
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Water Quality Calibration – Qualitative

- Based on Annual Average Difference of Simulated and Measured Loads
- Range
  - Very Good = -40 – 40%
  - Good = -90 – 90%
  - Fair = -150 – 150%
  - Poor = -225 – 225%

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Region 4 serving the southeast

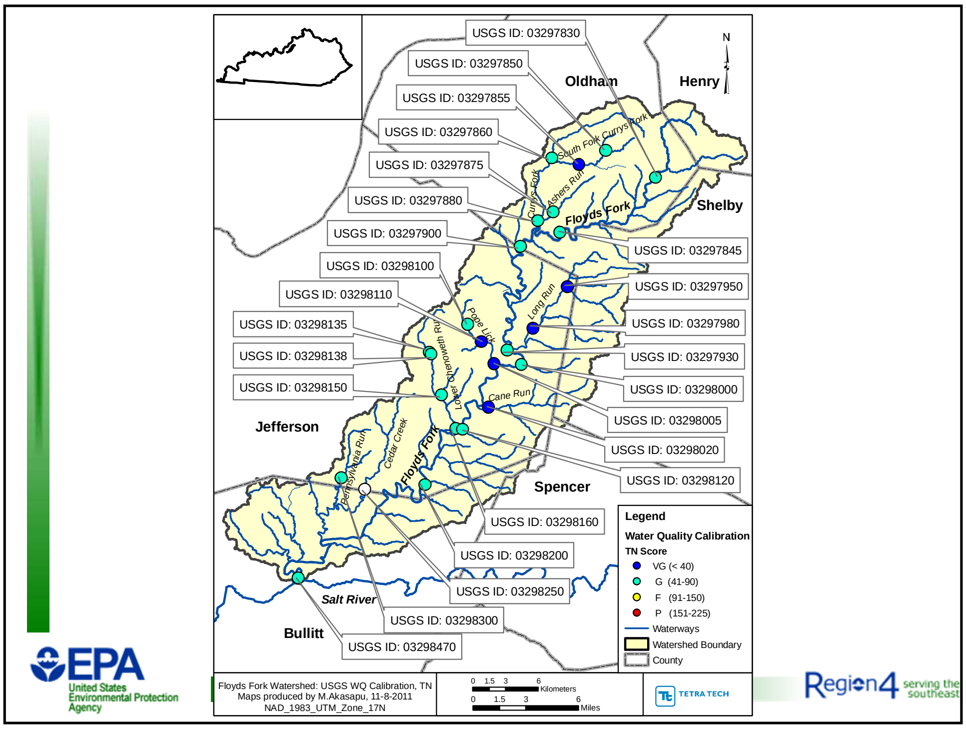
USGS WQ Stations - Location: Main Stem- Floyds Fork					
USGS Station ID	Station name	Qualitative Score		Quantitative Score	
		TN	TP	TN	TP
03297830	Floyds Fork at Highway 53	G	VG	45	16
03298470	Floyds Fork near Shepherdsville	G	VG	62	8
03298000	Floyds Fork at Fisherville	G	VG	53	23
03298200	Floyds Fork near Mt. Washington	G	VG	57	20
03298120	Floyds Fork at Seatonville Road	G	G	51	43
03297845	Floyds Fork near Crestwood	G	G	49	59
03297900	Floyds Fork near Peewee Valley	G	G	52	57
03297930	Floyds Fork at Echo trail bridge	G	G	71	66
USGS WQ Stations - Location: Tributaries					
03298005	Pope lick at South poope lick road near Fisherville	VG	VG	18	8
03297855	South Fork Curry's Fork at Highway 393	VG	VG	1	38
03298160	Chenoweth Run at Seatonville road near Jeffersontown	G	VG	48	1
03297950	Long Run at Old stage coach road	VG	G	11	47
03297880	Currys Fork near Crestwood	G	VG	45	30
03297980	Long Run near Fisherville	VG	G	25	53
03298135	Chenoweth Run at Ruckriegal Parkway	G	VG	62	17
03298110	Pope lick at Rehl road near Fisherville	VG	G	37	53
03298020	Chenoweth Run at Gelhaus Lane	VG	G	27	68
03298300	Pennsylvania Run at Mt. Washington	G	G	48	48
03297875	Ashers Run at Abbott lane near Crestwood	G	G	53	53
03298150	Chenoweth Run at Gelhaus Lane near Fern creek	G	G	67	42
03297850	South Fork Curry's Fork at Moody Lane	G	G	46	64
03298138	Chenoweth Run at Jeffersontown STP at Jeffersontown	G	G	68	62
03298100	Pope lick at pope lick road near Middletown	G	G	69	63
03297860	North Fork Curry's Fork at Stone Ridge road	G	G	73	72
03298250	Cedar Creek at Thixton Road	Not enough Data			

MSD WQ Stations - Location: Main Stem- Floyds Fork					
USGS Station ID	Station name	Qualitative Score		Quantitative Score	
		TN	TP	TN	TP
EFFFF003	Floyds Fork at Old Taylorsville Road	VG	VG	34	23
EFFFF002	Floyds Fork at Bardstown Road	G	VG	41	35
EFFFF001	Floyds Fork at Ash Avenue	G	VG	45	34
MSD WQ Stations - Location: Tributaries					
EFFCR001	Chenoweth Run # 1 at Gelhaus Lane	G	VG	56	26
EFFCR002	Chenoweth Run # 1 at Rickriegal Parkway	G	G	79	83

Summary

- USGS Stations
  - TN = 6 Very Good, 18 Good
  - TP = 9 Very Good, 15 Good
- MSD Stations
  - TN = 1 Very Good, 4 Good
  - TP = 4 Very Good, 1 Good

Region 4 serving the southeast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USGS ID: 03298110
USGS ID: 03298135
USGS ID: 03298138
USGS ID: 03298150
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USGS ID: 03297950
USGS ID: 03297980
USGS ID: 03297930
USGS ID: 03298000
USGS ID: 03298005
USGS ID: 03298020
USGS ID: 03298120
USGS ID: 03298160
USGS ID: 03298200
USGS ID: 03298250
USGS ID: 03298300
USGS ID: 03298470
N
Oldham
Henry
Shelby
Jefferson
Spencer
Bullitt
Salt River
South Fork Currys Fork
Ashers Run
Floyds Fork
Long Run
Pope Lick
Chenoweth Run
Cane Run
Cedar Creek
Pennsylvania Run
Legend
Water Quality Calibration
TN Score
VG (< 40)
G (41-90)
F (91-150)
P (151-225)
Waterways
Watershed Boundary
County
Floyds Fork Watershed: USGS WQ Calibration, TN
Maps produced by M.Akasapu, 11-8-2011
NAD_1983_UTM_Zone_17N
0 1.5 3 6 Kilometers
0 1.5 3 6 Miles
TETRA TECH
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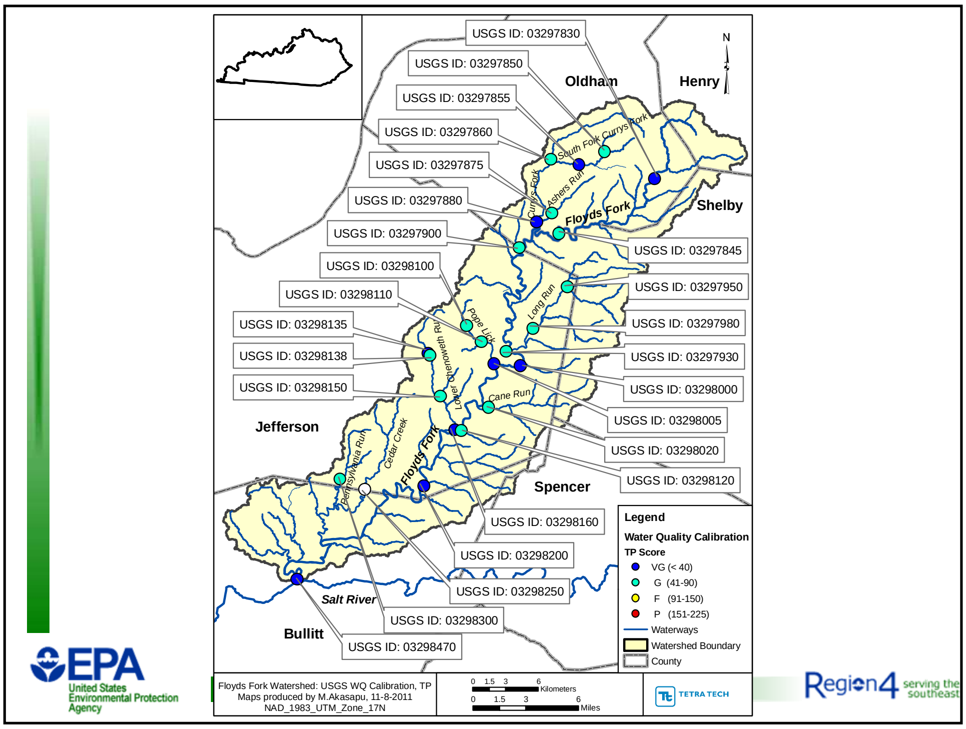
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USGS ID: 03298160
USGS ID: 03298200
USGS ID: 03298250
USGS ID: 03298300
USGS ID: 03298470
N
Oldham
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Waterways
Watershed Boundary
County
Floyds Fork Watershed: USGS WQ Calibration, TP
Maps produced by M.Akasapu, 11-8-2011
NAD_1983_UTM_Zone_17N
0 1.5 3 6 Kilometers
0 1.5 3 6 Miles
TETRA TECH
EPA
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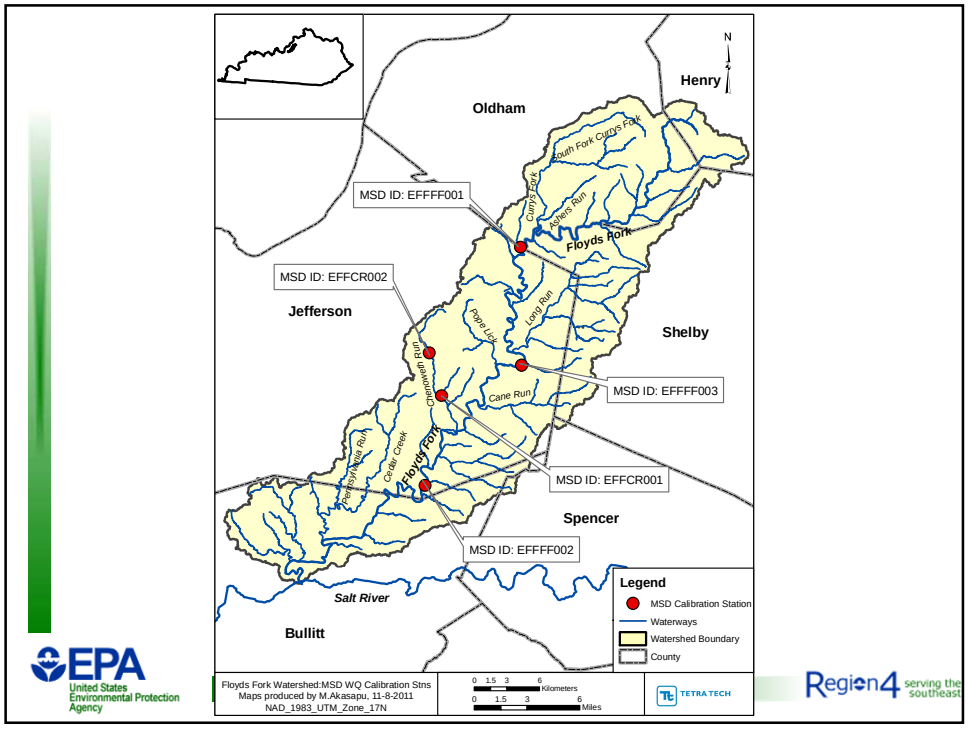
Henry
Oldham
Jefferson
Shelby
Spencer
Bullitt
Salt River
MSD ID: EFFFF001
MSD ID: EFFCR002
MSD ID: EFFFF003
MSD ID: EFFCR001
MSD ID: EFFFF002
South Fork Curds Fork
Curds Fork
Ashers Run
Floyds Fork
Pope Lick
Long Run
Cane Run
Cedar Creek
Pennsylvania Run
Legend
MSD Calibration Station
Waterways
Watershed Boundary
County
Floyds Fork Watershed:MSD WQ Calibration Stns
Maps produced by M.Akasapu, 11-8-2011
NAD_1983_UTM_Zone_17N
Kilometers
Miles
TETRA TECH
EPA
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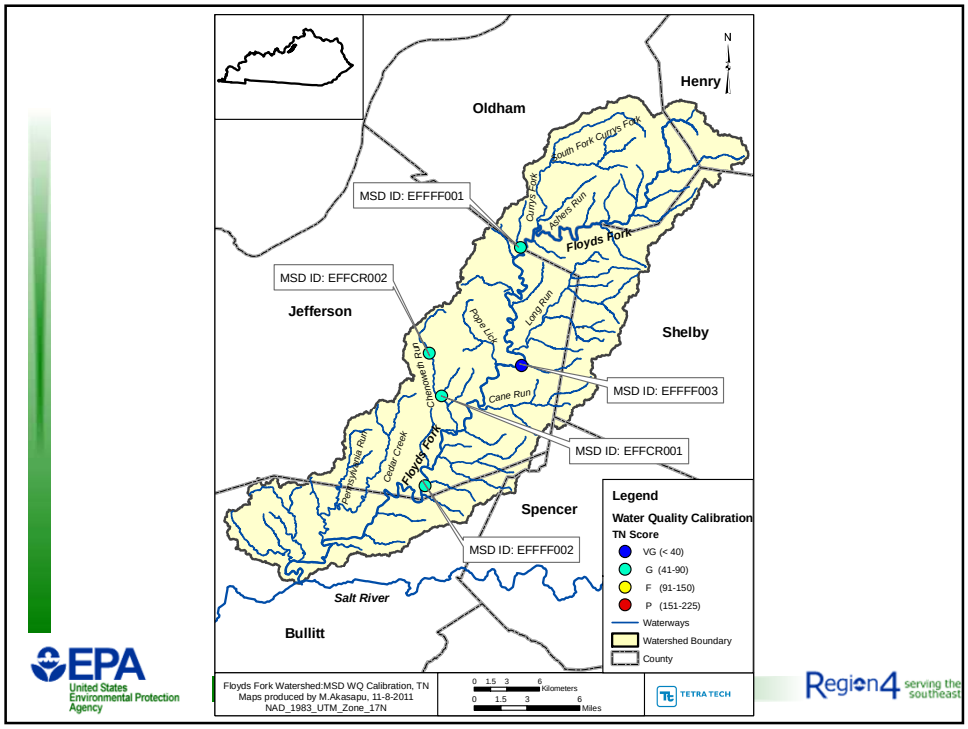
Henry
Oldham
Jefferson
Shelby
Spencer
Bullitt
Salt River
MSD ID: EFFFF001
MSD ID: EFFCR002
MSD ID: EFFFF003
MSD ID: EFFCR001
MSD ID: EFFFF002
South Fork Curds Fork
Curds Fork
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NAD_1983_UTM_Zone_17N
Kilometers
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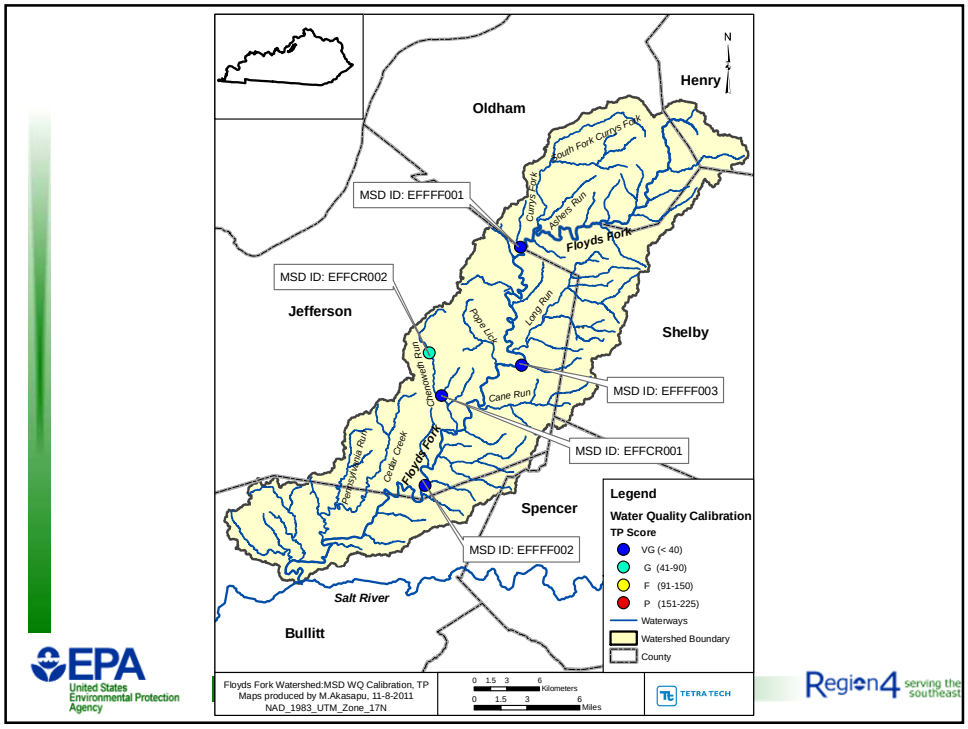

Next Steps

- Evaluate any new data sources
- Refine the watershed model
- Setup the instream river model
- Calibrate/validate the river model

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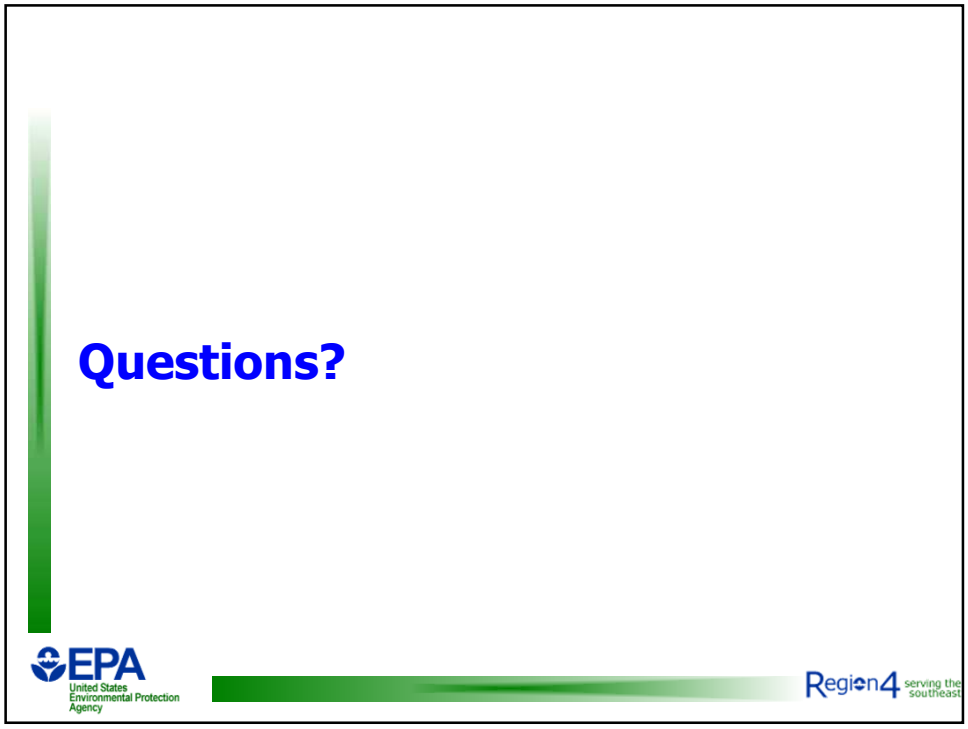
Questions?
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Environmental Protection
Agency
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